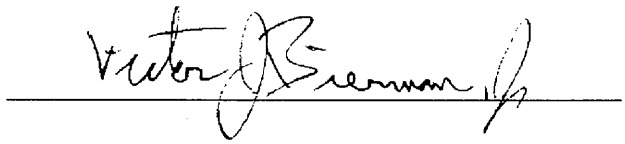
EXPERT REPORT OF VICTOR J. BIERMAN, JR.

State of Oklahoma, et al., Plaintiffs
v.
Tyson Foods, Inc., et al., Defendants

Case No. 05-CV-0329-GKF-SAJ

United States District Court for the Northern District of Oklahoma

January 23, 2009



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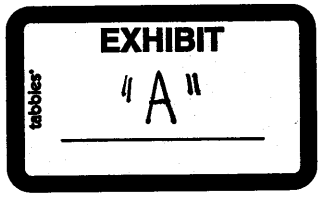
Senior Scientist



SUMMARY OF OPINIONS AND SUPPORTING STATEMENTS ON EXPERT REPORT BY DR. BERNARD ENGEL

1. **The entire construct put forth by Dr. Engel is fundamentally flawed. His modeling framework is conceptually flawed and not appropriate for the IRW.**
   a. The phosphorus mass balance in Dr. Engel's expert report is an inappropriate construct and is not relevant to the relationship between phosphorus sources and water quality.
   b. The GLEAMS model used by Dr. Engel is an inappropriate tool for predicting watershed-scale nonpoint source phosphorus loads to streams and rivers in the IRW.
   c. The phosphorus routing model developed by Dr. Engel is not a valid representation of the real system of streams and rivers in the IRW, and is an inappropriate tool for predicting delivery of phosphorus loads to Lake Tenkiller.

2. **The methods used by Dr. Engel in applying his modeling framework to the IRW are inconsistent with generally accepted practices in the scientific community, contain numerous and substantial errors, and are not reliable to a reasonable degree of scientific certainty.**
   a. The GLEAMS model developed by Dr. Engel for predicting nonpoint source phosphorus loads to streams and rivers in the IRW misrepresents important basic features of the watershed.
   b. Dr. Engel ignored most of the available data in the IRW when he provided the inputs for rainfall in his GLEAMS model.
   c. Dr. Engel ignored most of the available data in the IRW when he provided the inputs for initial soil phosphorus concentrations in his GLEAMS model.
   d. Dr. Engel ignored most of the numerous individual sources of phosphorus loads in the IRW when he provided the inputs to his GLEAMS model.
   e. Most of the inputs for Dr. Engel's GLEAMS model are default or generic values and are not based on conditions in the IRW.
   f. In contravention to generally accepted practices in the scientific community, Dr. Engel did not compare the predictions for hydrology from his GLEAMS model to any observed data in the State of Arkansas or to most of the observed data in the State of Oklahoma.
   g. In contravention to generally accepted practices in the scientific community, Dr. Engel did not compare the predictions for phosphorus loads to edge-of-field from his GLEAMS model to any observed data in the States of Arkansas or Oklahoma.
   h. In contravention to generally accepted practices in the scientific community, Dr. Engel did not compare the predictions for phosphorus loads from his routing model to any observed data in the State of Arkansas or to most of the observed data in the State of Oklahoma.

i. The calibration approach used by Dr. Engel for his models was circular and fundamentally flawed, and his purported validation is inconsistent with U.S. EPA guidance on environmental models.

j. Dr. Engel did not follow his own published guidance on procedures for standard application of hydrologic/water quality models.

k. The observed phosphorus loads to Lake Tenkiller calculated by Dr. Engel for his calibration and purported validation of his models are incorrect.

l. The simulations of future conditions conducted by Dr. Engel with his models fail to account for any changes in phosphorus loads due to changes hydrology, meteorology, population, land uses, urbanization or livestock in the IRW over the next 50 to 100 years.

m. The body of work put forth by Dr. Engel contains large numbers of errors, internal inconsistencies, incorrect unit conversions, incorrect labeling, missing files and missing or incomplete documentation.

3. **The modeling results put forth by Dr. Engel in his expert report are not accurate or reliable to a reasonable degree of scientific certainty.**

a. The routing model developed by Dr. Engel can be calibrated using a wide range of different watershed loadings, including random values; consequently, his calibration does nothing to corroborate his GLEAMS model outputs or his WWTP loads.

b. The opinion by Dr. Engel that poultry litter land application in the IRW is a substantial contributor to phosphorus loads to Lake Tenkiller is based on model results and methods that are conceptually flawed, incorrect and not reliable.

4. **The flawed and unreliable results put forth by Dr. Engel, and relied upon by other Plaintiffs' experts, create a domino effect and render the opinions of these other experts flawed and unreliable to the extent that they relied upon his results.**

a. The total phosphorus loads to Lake Tenkiller calculated by Dr. Engel for Dr. Wells to use for calibrating his model of Lake Tenkiller are incorrect; consequently, this calls into question Dr. Wells' entire model calibration.

b. The loads of dissolved ortho phosphate to Lake Tenkiller calculated by Dr. Engel for Dr. Wells to use for calibrating his model of Lake Tenkiller are based on the wrong form of phosphorus, which further calls into question Dr. Wells' entire model calibration.

c. The results for simulations of future phosphorus loads to Lake Tenkiller that Dr. Engel provided to Dr. Wells are flawed and unreliable; consequently, all of Dr. Wells' results that link future phosphorus loads to future conditions in the lake are also flawed and unreliable.

d. The results for simulations of future phosphorus loads that Dr. Engel provided to Dr. Stevenson are flawed and unreliable; consequently, all of Dr. Stevenson's results that link future phosphorus concentrations to future conditions in streams and rivers in the IRW are also flawed and unreliable.